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ABSTRACT

The primary objectives of this research program were the development of a battery of tests to investigate the effects of brain impairment on sensory and perceptual functioning. The Sensory-Perceptual Exam (SPE) contains measures intended to evaluate both relatively "pure" sensory functions, as well as those which involve more integrated and complex perceptual activities of higher cortical functioning. The tests thus far incorporated into the standard battery include the following: Spiral Aftereffect, Critical Flicker Fusion, Complex Reaction Time, Memory-for-Designs, Dot Determination, Auditory Pulse Rate Discrimination, Vestibular Perception of Vertical and Proprioceptive Perception of Vertical, Tactile Form Discrimination, and Color-Word Rigidity. Table 1 of the report demonstrates that SPE performance is responsive to degree of cerebral impairment. The data of Table 2 demonstrate the potential usefulness of several of the tests for possible differential diagnostic application. (DB)

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The Expanded Sensory-Perceptual Examination as a Diagnostic Screening Instrument for Organic Brain Damage

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The primary objectives of our program of research have been the development of a battery of tests to investigate the effects of brain impairment on sensory and perceptual functioning. It has been our intent to develop the Sensory-Perceptual Exam (SPE) as both a research and a clinically useful instrument. The measures of the test battery are intended to evaluate both relatively "pure" sensory functions as well as those which involve more integrated and complex perceptual activities of higher cortical functioning.

The tests thus far incorporated into the standard battery include the following:

1. Spiral Aftereffect (SAE) - longevity of aftereffect is measured in seconds.
2. Critical Flicker Fusion (CFF) - fusion of a flickering light to steady is measured in hertz.
3. Complex Reaction Time (CRT) - the time required to respond to a specific combination of lights measured in seconds.
4. Memory-For-Designs (MFD) - the standard MFD scored by the Graham-Kendall system.
5. Dot Determination (DOT) - 16 slides containing from 1 to 16 circular solid dots are presented tachistoscopically at 1/50 sec, with score being total errors in estimated number.
6. Auditory Pulse Rate discrimination (APD) - white noise at different pulsation frequencies presented in pulse pairs with the difference threshold determined in hertz at each of 5 different pulse frequencies.

7 & 8. Vestibular Perception of Vertical (VPV) and Proprioceptive Perception of Vertical (PPV) - two measures obtained using a tilt chair which measures errors (in degrees) of estimating vertical with either the head tilted (VPV) or the body tilted (PPV) 30° to the left or right of vertical.

9. Tactile Form Discrimination (TFD) - a form board with eight geometric shapes (modified Seguin Goddard formboard) used to measure errors in recognizing the shapes and the time required to make the decision for right, left and cross handed performance.
10. Color-Word Rigidity (CWR) - a modification of the Stroop test measuring total time + errors in reading a card containing 17 color names printed in conflicting colors.

We have demonstrated (Table 1) that SPE peformance is responsive to degree of cerebral impairment. Patients who were evaluated by standard neurological exam and, in many cases, other special diagnostic procedures

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were rated as to degree of impairment in cerebral functioning on a five point scale from zero to four. Patients were also classified by localization of brain impairment or specific type of neurologic disorder into seven different classes, including diffuse (D) right side (R), left side (L), alcoholic (A), questionable alcoholic (QA), multiple sclerotic (MS), and seizure disorder (S). In addition data were obtained on normal (N) and psychiatric (P) patient groups. The data of Table 2 demonstrate the potential usefulness of several of the tests for possible differential diagnostic application. The scores presented in Table 2 do not contain all the information obtained on the various tests since they are global summary scores. One of the most provocative tests thus far has been the tilt chair with the different head and body scores. Different patterns of performance on this test have been demonstrated by most of our patient groups shown in Table 2. Work continues on the characterization of different profiles which may be specific for each organic disability.

TABLE 1

Analysis of Variance of Performance of Five Organic Impairment Groups on the Sensory-Perceptual Examination (Ten Tests and Average z Score for All Tests) and Analysis of Variance of Age and Education Differences among Groups

Test	Impairment Group															F
	0			0+			1			2			3			
	N	X	SD	N	X	SD	N	X	SD	N	X	SD	N	X	SD	
SAE	64	14.4	7.68	72	15.2	8.52	56	12.1	3.30	38	10.3	8.77	34	9.4	8.83	4.38
CFF	64	31.9	3.32	73	31.1	3.37	54	29.1	4.65	36	28.0	5.12	34	26.7	5.10	11.66
CRT	64	0.48	0.13	73	0.51	0.14	55	0.52	0.16	39	0.72	0.22	36	1.02	0.51	39.09
MFD	36	5.1	4.37	39	4.5	5.08	32	4.7	3.86	22	7.6	5.80	21	14.2	8.18	13.96
DOT	64	15.0	6.11	73	16.0	5.27	55	18.1	7.34	36	22.2	11.28	35	39.2	22.03	36.69
APD	63	5.1	2.15	69	5.8	3.66	56	5.7	2.89	37	7.8	4.12	31	7.1	3.23	5.02
VPV	57	70.7	39.16	68	86.0	43.22	49	90.1	55.33	33	117.2	73.39	28	127.3	87.14	6.56
PPV	57	46.4	44.58	68	47.5	31.90	49	63.4	53.69	32	105.2	78.03	27	116.6	96.69	13.00
TFD	41	5.1	5.09	56	5.1	4.10	38	6.4	5.11	20	12.5	7.35	19	16.9	7.47	23.89
CWR	62	87.5	22.52	69	90.3	23.70	57	99.9	35.25	39	145.4	51.52	37	161.8	44.07	44.40
z	64	+0.34	0.33	73	+0.29	0.37	57	+0.06	0.49	40	-0.46	0.57	37	-0.99	0.71	64.16
AGE	64	44.3	13.80	73	42.9	12.78	58	42.2	11.90	40	47.4	13.09	37	48.6	14.56	2.07*
EDU	64	11.4	2.50	73	11.7	2.65	57	11.9	3.13	37	12.1	3.16	35	11.5	3.02	0.43*

*These F values are not significant at the .05 level. All other F values are significant beyond the .001 level.

TABLE 2

Analysis of Variance of Performance of Nine Patient Groups
on the Sensory-Perceptual Examination

Measure		Patient Groups									F
		N (n=56)	D (n=33)	R (n=29)	L (n=27)	A (n=14)	GA (n=19)	BS (n=17)	S (n=15)	PSY (n=35)	
SAL	$\bar{X}$	13.79	13.87	9.64	9.98	13.15	14.88	9.71	15.63	19.90	3.79**
	SD	6.47	12.50 (n=32)	5.79	6.72 (n=25)	7.17	7.00	7.42	5.85	14.58	
CFT	$\bar{X}$	32.29	28.07	28.02	30.11	23.51	30.17	24.64	31.67		7.58**
	SD	3.05	5.34 (n=29)	5.84 (n=25)	4.25	3.80 (n=12)	2.77	7.09	2.34		
CRT	$\bar{X}$	0.48	0.80	0.74	0.73	0.57	0.50	0.56	0.48	0.65	6.28**
	SD	0.14	0.50 (n=32)	0.35	0.23	0.18 (n=28)	0.17	0.17 (n=16)	0.05	0.26	
MFD	$\bar{X}$	4.93	9.01	8.71	8.47	7.94	2.82	3.50	3.81	4.22	3.27**
	SD	4.22 (n=32)	10.37 (n=15)	6.80 (n=19)	7.07 (n=17)	2.92 (n=9)	2.22 (n=11)	1.75 (n=8)	3.56 (n=9)	3.59	
DOT	$\bar{X}$	14.74	28.08	24.72	26.83	18.58	15.66	20.63	14.73	23.43	5.39**
	SD	6.03	23.23 (n=30)	14.24	13.43	6.00 (n=13)	5.13	8.18 (n=16)	3.80	11.29	
APD	$\bar{X}$	5.03	7.00	6.77	7.24	7.29	6.16	4.33	6.48	6.21	2.39*
	SD	2.08 (n=55)	3.26 (n=31)	3.83 (n=26)	3.53 (n=25)	4.00 (n=12)	4.59 (n=18)	2.55 (n=16)	4.57	2.51	

Measure		N (n=56)	D (n=33)	R (n=29)	L (n=27)	A (n=14)	QA (n=19)	ES (n=17)	S (n=15)	PSY (n=35)	F
VPV	$\bar{X}$	70.00	101.50	111.91	97.15	135.83	113.05	65.07	86.58	58.34	5.67**
	SD	40.41	60.63	50.61	63.77	99.06	53.67	36.97	46.38	30.04	
		(n=50)	(n=24)	(n=23)	(n=26)	(n=12)	(n=18)		(n=14)		
PPV	$\bar{X}$	45.66	90.54	82.26	80.73	122.17	49.72	46.32	51.13	50.89	4.22**
	SD	46.82	73.51	54.89	75.38	112.61	44.84	25.49	28.79	27.61	
		(n=50)	(n=24)	(n=23)	(n=26)	(n=12)	(n=18)		(n=14)		
SFD	$\bar{X}$	4.63	9.75	11.06	11.27	8.77	4.06	5.40	4.46	8.57	4.87**
	SD	4.79	5.25	8.02	9.24	5.59	3.29	4.31	3.55	4.36	
		(n=36)	(n=16)	(n=16)	(n=18)	(n=9)	(n=16)	(n=10)	(n=13)		
CUM	$\bar{X}$	85.36	132.25	110.10	158.88	121.07	98.94	103.47	90.66	100.76	10.95**
	SD	22.88	48.87	42.30	55.54	47.07	42.48	32.10	20.62	25.23	
		(n=55)	(n=31)							(n=34)	
QT	$\bar{X}$	100.7	96.1	97.3	88.5	99.4	99.6	103.6	95.8	95.8	3.00**
	SD	10.5	12.2	13.5	19.5	11.6	10.2	14.9	9.0	9.7	
			(n=32)		(n=28)						
AGR	$\bar{X}$	43.6	48.6	41.8	44.2	46.2	41.5	41.5	41.2	43.06	1.0
	SD	13.7	15.7	13.1	14.3	5.9	6.7	7.4	12.4	7.36	
					(n=29)						
IMP	$\bar{X}$	0.00	2.06	2.00	2.20	1.42	0.50	1.12	0.50	0.00	
	SD	0.00	0.99	0.84	1.04	0.64	0.00	0.45	0.00	0.00	
					(n=29)						

*p<.05
**p<.01
Based on 8 groups only